FOREST PEST MANAGEMENT
Pacific Southwest Region

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3420 Biological Evaluation

A Biological Evaluation of the Green Valley Creek area, Green Flats Fuelwood Sale, Arrowhead Ranger District, San Bernardino National Forest

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ABSTRACT

An evaluation of the Green Valley Creek area, Green Flats fuelwood sale, on the Arrowhead Ranger District, San Bernardino National Forest, indicated high levels of annosus root disease in Jeffrey pine and white fir. True mistletoe was present at damaging levels on white fir, and less critically on incense-cedar. Fir engraver beetle was active in white fir. The biologies of the major pests are presented and alternatives for their management discussed.

INTRODUCTION

At the request of Ernest Del Rio, Silviculturist, San Bernardino National Forest, the Green Valley Creek area of the Green Flats fuelwood sale, was examined on November 3, 1988 by Susan Frankel, Plant Pathologist, and John Dale, Entomologist, of the Forest Pest Management staff. They were accompanied by Mark Bethke, Resource Forester, Arrowhead Ranger District. The Green Flats Fuelwood Sale area is being managed for dispersed recreational use. Sightseeing and wood cutting are popular activities in this area. The objectives of the evaluation were to determine the cause of high levels of tree mortality in the Green Valley Creek area and to present pest impact information for consideration in stand management.

OBSERVATIONS

The total project area ia approximately 500 acres in size. This report covers only the area adjacent to Green Valley Creek. Vegetative cover consists of an

overstory of white fir, Jeffrey pine, ponderosa pine, and Coulter pine, with incense-cedar and sugar pine in some areas. Trees range from 10" to 38" DBH and are from 30-200+ years old. Black oaks, and live oak of all ages are present throughout. The understory consists of white fir, Jeffrey pine, ponderosa pine, Coulter pine and occasional incense-cedar. Some overstory trees were removed 10 to 15 years ago and many large stumps are scattered throughout the area. Forest personnel have noticed that trees have been dying at an unusually high rate. Firewood cutters have been removing these trees. There are fresh stumps and scattered mortality throughout all size classes in fir and pine. Stocking is inconsistent, with dense clusters of trees surrounded by small openings. Regeneration is dying around stumps throughout the area, preventing closure of stand openings.

Annosus root disease, caused by Heterobasidion annosum (Fomes annosus), is widespread in both pine and fir throughout this area. Conks and characteristic rot were found in association with dying overstory and understory trees and also in fir and pine stumps.

Infections of the true mistletoe, Phoradendron bolleanum ssp. pauciflorum, are numerous in white fir. Although it is usually found in the tops of trees, even the boles and branches of understory white fir are infected. True mistletoe infection level varies from light to severe within the area. The true mistletoe, Phoradendron juniperinum ssp. libocedi, is only lightly present in the incense-cedar. The dwarf mistletoe Arceuthobium californicum is present in the sugar pine, but infection is light and insufficient for damage. True mistletoe (Phoradendron villosum) is also present in the oaks, with infection varying from light to severe. The fir engraver, Scolytus ventralis, is killing branches in the tops of some overstory white fir.

PEST MANAGEMENT ALTERNATIVES

1. No change in present management. The activity of annosus root disease will continue in the fuelwood sale area causing mortality and windthrow of conifers. The disease will persist in the infected stumps and roots until the wood has been completely rotted. Conifers on the edge of active annosus centers will become infected and will continue to die, often after being attacked by bark beetles or flatheaded borers. Conifers in the annosus root disease centers will become infected and die as their roots reach old infected roots and stumps. The fungus will thus be perpetuated in the area.

Tree aggregations with high basal areas have a high probability of being attacked by bark beetles or engraver beetles during periods of low precipitation.

True mistletoe in white fir will cause problems in some infected trees as infections increase. Infected branches in the tops of trees will continue to be attacked by the fir engraver. Subsequent attack by the fir engraver may continue down the bole causing tree mortality if other stresses such as drought or overstocking are present or if the amount of true mistletoe is quite high. The height growth of the infected understory may be so impaired that it will have a difficult time reaching the level of the overstory.

2. Reduce the impact of Heterobasdion annosum. Once annosus root disease is established in a stand, no direct control is available. Control, therefore, involves prevention of new centers and decreasing the risk of stump infection, and silvicultural manipulations of infected stands to minimize the effects of the disease. The following alternatives are available:

a. Prevent stump infection. Application of granular borax to freshly cut coniferous stumps is effective in preventing most new infections. The chemical is toxic to spores of H. annosum, but has no effect on existing infections.

b. Plant and favor hardwoods. Revegetation of active centers should be done only with resistant species. All conifers are susceptible to the fungus. Leaving the centers barren or planting them with resistant hardwoods will result in the fungus eventually dying out so conifers can once again successfully be established. Unfortunately this will take 50 or more years. Favoring the oaks already present and planting other suitable hardwood trees or shrubs will provide shade as well as establish a barrier of nonsusceptible roots that may limit the spread of annosus centers.

c. Stump and root removal. Removal of as much infected material as possible may disrupt the underground network for fungal spread and establish a barrier to further spread. After the fine roots that remain in the soil have completely decomposed, the site will be suitable for conifer regeneration. Recently cut stumps within a disease center, both infected and uninfected, could be removed by excavation with a backhoe or manually. The efficacy of stump and root removal has not been tested in California.

d. Thinning. Thinning will increase tree vigor and thus reduce the risk to disease and insects. Thinning dense stands of conifers will minimize opportunities for root contact and subsequent spread of H. annosum. Stumps created during thinning should be treated with borax and slash created should be chipped, burned, removed from the site or lopped and exposed to the sun to minimize engraver buildup. Removal of white fir heavily infected with mistletoe will increase stand vigor.

e. Patchcuts. This would be similar to thinning, accomplishing sanitation, stocking, and species control. In heavily infected areas patch cuts could be regenerated with brush species and oaks, thereby meeting wildlife objectives. Patch cuts would probably need to be no more than 1/2 acre in size.

If you have any questions about this report or need further assistance with this or any other pest management problem, Forest Pest Management personnel are available to provide technical assistance both on the ground and in the planning process in order to reduce pest-related losses.

PEST BIOLOGIES

ANNOSUS ROOT DISEASE

Heterobasidion annosum is a fungus that attacks a wide variety of woody plants. All western conifer species are susceptible. Madrone (Artemisia menziesii), and a few brush species (Arctostaphylos spp. and Artemisia tridenta) are occasional hosts. Other hardwood species are apparently not infected. The disease has been reported on all the National Forests in California, with incidence particularly high on true fir in northern California campgrounds. Incidence is also very high in Southern California recreation areas on San Bernardino and Cleveland National Forests.

During periods favorable to the fungus, fruiting bodies (conks) form in decayed stumps, under the bark of dead trees, or under the duff at the root collar. New infection centers begin by aerial spread of spores produced by the conks and subsequent colonization of freshly cut stump surfaces or wounds on living trees. The fungus then spreads through root contacts into the root systems of adjacent susceptible trees. Local spread of the fungus from a stump typically results in the formation of a disease center, with dead trees in the center and fading trees on the margin. These centers usually continue to enlarge until they reach natural barriers such as stand openings or non-susceptible plants.

In pines, H. annosum grows through root cambial tissue to the root crown where it girdles and kills the trees. In less resinous species such as true firs, the fungus sometimes kills trees, but more frequently it is confined to the heartwood and inner sapwood of the larger roots where it causes a chronic butt and root decay and growth loss. Thus, while infection in true fir usually does not kill the host, it does affect its growth and thriftiness. Losses in true fir from H. annosum are mainly the result of windthrow resulting from root decay, and reduced root systems which predispose trees to attack and eventual death by the fir engraver beetle. Field observations suggest that vigorous young firs are usually able to regenerate root tissues faster than they are lost to the root disease. But when true firs slow in growth because of stand and/or site conditions, root development decreases to where there is a net loss in roots and the trees slowly decline due to the gradual loss of their root systems. This decline may take 10 to 20 years before tree death occurs.

In general, infections will cross from roots of pine to roots of true fir; however, rarely is the fungus observed to cross from true fir to pine. At higher elevations where pine and true fir are intermixed, F. annosus is commonly found only on true fir and mortality rarely includes both species within an infection center.

WHITE FIR TRUE MISTLETOE

White fir mistletoe, Phoradendron bolleanum ssp. pauciflorum, is a true mistletoe having small, green leaves and round, white berries. It can only survive in living white fir tissues, principally as a water parasite utilizing water and minerals from the host. In California, it is limited geographically to the Sierra Nevada south of Interstate 80, and to the mountains of southern California.

This pest is spread mainly by birds, including robins, bluebirds, thrushes, phainopeplas, and cedar waxwings. Birds feed on the berries, digest their pulp, and excrete the living seed, often depositing them onto susceptible trees. A viscous coating and hair-like threads on the outer surface of the seeds attach them firmly to twigs and branches, where they germinate and infect host tissues.

In nearly all cases, initial infection occurs on the branches of larger or older trees because birds prefer to perch in their tops. Severe buildup of mistletoe often occurs in an already-infected tree because birds are attracted to and may spend prolonged periods feeding on the mistletoe berries.

Heavily infected trees are weakened, reduced in growth rate, and sometimes killed. Weakened trees are predisposed to attacks by insects and often die during drought or other periods of stress. Severe infection of white fir can result in top-kill in combination with the fir engraver (Scolytus ventralis). Branches and tree tops heavily-laden with true mistletoe often break during wind storms, increasing the hazard to people and property in campgrounds and other developed sites.

White fir mistletoe is recognized by the clumps of mistletoe foliage in the tree. These mistletoe plants are usually in the tops of larger, older trees. With severe infections, virtually all of the tree's foliage may be replaced by mistletoe plants.

FIR ENGRAVER

The fir engraver (Scolytus ventralis) attacks both white and red fir in California. Trees ranging in size from large saplings to overmature sawtimber are susceptible. Attacks can cause patch-killing of cambium along the bole, top-kill, or tree death. Top-kill or death occur most often in firs that have been weakened by root disease, dwarf mistletoe, overstocking, soil compaction, sunscald, logging injury, or drought. The fir engraver also breeds in slash and windthrown trees.

The fir engraver usually completes its life cycle in one year, sometimes two. Adults fly and bore into trees or green fir slash from June to September; larvae, pupae, and adults over-winter under the bark. Pitch tubes are not formed as they are with pine bark beetles; the usual evidence of attack is boring dust in bark crevices along the trunk and pitch streamers on the mid and upper bole. Trees colonized early in the summer may begin to fade by early fall, but those colonized later in the year usually do not fade until the following spring or summer, often after the beetles have emerged.